MAY 16 2003

**U. S. ENVIRONMENTAL PROTECTION AGENCY**
**WASHINGTON, DC 20460**

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

May 7, 2003
PC Code: 014504
DP Barcode: 290057

**MEMORANDUM**

SUBJECT: Estimated Drinking Water Concentrations of Ethylenebisdithiocarbamate (EBDC) Degradate Ethylenethiourea (ETU) for the Use in Human Health Risk Assessment

FROM: Ronald Parker, Senior Environmental Engineer, Ph.D.
Environmental Risk Branch V
Environmental Fate and Effects Division (7507C)

Mohammed Ruhman, Agronomist, Ph.D.
Environmental Risk Branch V
Environmental Fate and Effects Division (7507C)

THROUGH: Mah T. Shamim, Ph.D., Chief 5/13/03
Environmental Risk Branch V
Environmental Fate and Effects Division (7507C)

TO: Anne Overstreet, Product Manager
Registration Division

AND Christina Swartz
Health Effects Division

**Summary**. This memo presents the Estimated Drinking Water Concentrations (EDWCs) for the EBDC degradate ETU. for use in an FQPA human health risk assessment. The EBDC fungicides, Metiram, Maneb and Mancozeb are very short lived in soil and in water and would not themselves reach water used for human consumption whether from surface water or groundwater. Ethylenethiourea (ETU) is a common degradate of all of the EBDC fungicides and may reach both surface and groundwater under some conditions. This assessment addresses concentrations of ETU only. The surface water estimates are calculated using the linked USEPA PRZM and EXAMS simulation models. For **surface water**, the **acute (peak) value of 48.2 ppb** as well as the **long-term average of 2.8 ppb** are based on application of an EBDC fungicide on apples in Pennsylvania. The combination of the permitted application amount for apples and the

weather and soil conditions in simulated in Pennsylvania produce the highest EDWC chronic values. The calculation assumes very rapid degradation of the parent pesticide to ETU on a mole per mole basis and is assumed rather than modeled. **The groundwater EDWC concentration is 0.21 ppb** and is derived from community water system intake concentration a targeted groundwater monitoring study conducted by the EBDC task force from 1999 to 2003. Both these surface and groundwater values represent upper-bound conservative estimates of the total ETU residual concentrations that might be found in surface water and groundwater due to the use of the EBDC fungicides.

**Estimation of Drinking Water Concentrations**

***Surface Water Approach:***

Limited surface water monitoring data was collected by the industry EBDC taskforce. No concentration values were measured above the method detection limit for ETU of 0.1 ppb. However, the sites were not vulnerable sites in terms of soil properties or water body size and samples were collected only every two weeks during the use season. The Agency has been unable to locate and other surface water monitoring data for the EBDC fungicides or for ETU. These chemicals were not included in the US Geological Survey NAWQA sampling program because the test methods are incompatible with the methods used by that program. NAWQA measurements are frequently the best national source of pesticide monitoring data. For this reason, the Agency has decided to base this report on simulated values using the USEPA PRZM and EXAMS programs.

***Modeling Approach for Surface Water EBDC's:***

Tier II drinking water estimates for ETU in surface water are calculated using the linked USEPA PRZM and EXAMS simulation models. This calculation assumes very rapid and complete degradation of the parent pesticide to ETU on a mole per mole basis. The modeling is performed using 4 applications of a modified application rate of 2.08 pounds per acre of ETU (4.8 pounds per acre multiplied by the moler degradation ratio of 0.3855) to account for the parent to degradate transformation. The combination of the permitted application amount for apples and the weather and soil conditions in simulated in Pennsylvania produce the highest EDWC chronic values.

A Tier II EDWC for a particular crop or use is based on a single index reservoir site that represents a high exposure scenario for the crop or use. The scenarios are indexed to a vulnerable former drinking water reservoir located in Shipman, Illinois. Weather and agricultural practices are simulated at the site for 30 years to estimate the probability of exceeding a given concentration (maximum concentration or average concentration) in a single year. Maximum EDWCs are calculated so that there is a 10% probability that the maximum concentration in a given year will exceed the EDWC at the site. This can also be expressed as an expectation that water concentrations will exceed EDWCs once every 10 years. Summary of these results can be seen in Table 1 as follows:

**Table 1. Application and Estimated Drinking Water Concentration Information**

| Item | Value | Source |
|---|---|---|
| Application Rate of Parent on Apples (lbs/acre) | 4.8 | Pesticide Labels |
| Moler Conversion Rate to Degradate (mole/mole) | 0.3855 | Conversion by Molecular Weights |
| Acute Surface Water Concentration of ETU (ppb) | Acute: 48.2 | PRZM/EXAMS |
| | Chronic: 2.8 | |

***Sources of Conservatism in Surface Water Modeling Scenario***

There are two primary sources of conservatism built into the surface water modeling for this chemical. First, is the use of a percent cropped area of 87% of the watershed which contributes pesticide through runoff to the reservoir. This is a default value which is used until the Agency develops an official PCA for apples. The second is the assumption of 100% treatment of all apples in the watershed by an EBDC fungicide.

***Monitoring Approach for Groundwater EBDC's***

Groundwater Estimated Drinking Water Concentrations (EDWC's) for the EBDC fungicides were developed from a targeted drinking water monitoring study conducted by the EBDC task force. Higher groundwater concentration values have been measured but are very rare and are unlikely to represent groundwater ETU concentrations expected in drinking water relevant for use in a national assessment. A value of 16 ppb was recorded beneath an Iowa apple orchard which had been treated with an EBDC fungicide. This value far exceeds any values monitored by the task force on the most vulnerable sites nationally and is therefore not believed to represent a true level of risk by the Agency. In 25 years of monitoring in California, there has been only one ETU detection (0.75 ppb). In the targeted monitoring study carried out by the EBDC Task Force from 1999 through 2003 the highest measured value in a public drinking water well was 0.210 ppb in Lee County, Florida and is used as the maximum value for this assessment. The highest measured value in a private well near an EBDC treated field was 0.574 ppb in an apple growing region of New York. Based on this evidence and SCIGROW assessment which follows, the higher measured values are unlikely to be relevant to this report.

***Modeling Approach for Groundwater EBDC's***

The above monitored value were also evaluated for reasonableness by checking them against the high exposure tier one model SCIGROW, which is described below. The SCIGROW value is 0.017 ppb. See table 2 below and the description of the SCIGROW model. This also would indicate that the upper level monitored values are unlikely to be exceeded even under the most vulnerable conditions.

**Table 2. Summary of Input Parameters for Tier I Estimated Drinking Water Concentrations (EDWC's)**

| Parameter | ETU | Reference |
|---|---|---|
| **Model : SCIGROW** | | |
| Crop | Apples | High Exposure |
| Label Application Rate (lb a.i./A) | 4.8 | Maximum label rate |
| Label Maximum Seasonal Number of Applications | 4 | Maximum label application number |
| Molar fraction ETU | 0.3855 | Molecular weight based conversion |
| Aerobic Soil Metabolism Half-life (Days) | 2.07 | Average for two soils (MRID 457445-01) |
| $K_{OC}$ (L/Kg) | 34 | Lowest value (MRID 002588-96); presence of 3 fold variations (Guidance Document) |
| **Model: PRZM/EXAMS** | | |
| Method of Application | Aerial | Label |
| Aerobic Soil Metabolism Half-life (Days) | 3.14 | Upper confidence bound on the mean for two soils (MRID 457445-01) |
| Aerobic Aquatic Metabolism Half-life (Days) | 6.28 | Aerobic Soil Metabolism Half-lifex2 |
| Anaerobic Aquatic Metabolism Half-life (Days) | 447 | 149 days x3 (MRID 001633-35); Only one value is available (Guidance Document) |
| $K_{oc,}$ (L/kg) | 288 | Lowest non-sand value (MRID 002588-96) |
| Solubility (ppm) | 20,000 | Product Chemistry Submissions |
| Vapor Pressure (Torr) | 9.728e-1 | Product Chemistry Submissions |
| Hydrolysis Half-life: pH 7 (Days) | Stable | Stable |
| Aqueous Photolysis Half-life: pH 5 (Days) | Stable | Stable |
| Foliar Half-life (Days) | 10 | Crop Residue Studies |
| Percent Crop Area (PCA) | 0.87 | 0.87 |

***Table 2. SCIGROW Input and Results.***

SCIGROW

VERSION 2.2: NOVEMBER 1, 2001

RUN No. 1 FOR ETU ** INPUT VALUES **

| APP RATE (LBS/AC) | APPS/ YEAR | TOTAL/ SEASON | SOIL KOC | AEROBIC SOIL METAB HALFLIFE (DAYS) |
|---|---|---|---|---|
| 2.08 | 4 | 8.320 | 34.0 | 2.07 |

GROUND-WATER SCREENING CONCENTRATION (IN UG/L - PPB)

.017013

***Background Information on the PRZM and EXAMS models and the Index Reservoir Scenario***

The linked PRZM and EXAMS models are used in this case as a second tier screen designed to estimate the pesticide concentrations found in water for use in drinking water assessments. They provide high-end values on the concentrations that might be found in a small drinking water reservoir due to the use of pesticide. The Drinking Water Index Reservoir scenario includes a 427 acres field immediately adjacent to a 13 acres reservoir, 9 feet deep, with continuous site-specific flow. This amount can be reduced due to degradation in field and the effect of binding to soil. Spray drift is equal to 6.4% of the applied concentration from the ground spray application and 16% for aerial applications.

The PRZM/EXAMS modeling system with the Index Reservoir scenario also makes adjustments for the percent cropped area. While it is assumed that the entire watershed would not be treated, the use of a PCA is still a screen because it represents the highest percentage of crop cover of any large watershed in the US, and it assumes that the entire crop is being treated. Various other conservative assumptions of this scenario include the use of a small drinking water reservoir surrounded by a runoff-prone watershed, the use of the maximum use rate and no buffer zone.

***Background Information on SCIGROW:***

SCI-GROW is a screening model which the Office of Pesticide Programs (OPP) in EPA frequently uses to estimate pesticide concentrations in vulnerable ground water. The model provides an exposure value which is used to determine the potential risk to the environment and to human health from drinking water contaminated with the pesticide. The SCI-GROW estimate is based on environmental fate properties of the pesticide (aerobic soil degradation half-life and linear adsorption coefficient normalized for soil organic carbon content), the maximum

application rate, and existing data from small-scale prospective ground-water monitoring studies at sites with sandy soils and shallow ground water.

Pesticide concentrations estimated by SCI-GROW represent conservative or high-end exposure values because the model is based on ground-water monitoring studies which were conducted by applying pesticides at maximum allowed rates and frequency to vulnerable sites (i.e., shallow aquifers, sandy, permeable soils, and substantial rainfall and/or irrigation to maximize leaching). In most cases, a large majority of the use areas will have ground water that is less vulnerable to contamination than the areas used to derive the SCI-GROW estimate. SCIGROW provides a groundwater screening exposure value to be used in determining the potential risk to human health from drinking water contaminated with the pesticide. SCIGROW estimates likely groundwater concentrations if the pesticide is used at the maximum allowable rate in areas where groundwater is exceptionally vulnerable to contamination. In most cases, a large majority of the use area will have groundwater that is less vulnerable to contamination than the areas used to derive the SCIGROW estimate.